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A NEW SPECIES OF FRESHWATER AMPHIPOD, *AUSTROCHILTONIA DALHOUSIENSIS* SP. NOV., (CRUSTACEA: AMPHIPODA: HYALELLIDAE) FROM DALHOUSIE SPRINGS, SOUTH AUSTRALIA

by W. ZEIDLER*

Summary

ZEIDLER, W. (1997) A new species of freshwater amphipod *Austrochiltonia dalhousiensis* sp. nov. (Crustacea: Amphipoda: Hyalellidae) from Dalhousie Springs, South Australia. *Trans. R. Soc. S. Aust.* **121**(1), 29-42, 30 May, 1997.

A freshwater amphipod *Austrochiltonia dalhousiensis* sp. nov. is described and illustrated. It is endemic to a few artesian springs amongst the Dalhousie Springs complex in the north of South Australia. Morphologically it is very similar to other species of *Austrochiltonia* found in mound springs near Lake Eyre South but preliminary electrophoretic analysis of allozymes supports the recognition of a distinct species. It most closely resembles *A. australis* (Sayce, 1901) in that uropod 3 is two-articulate, but differs in a number of minor features, which collectively distinguish it from its congeners.

KEY WORDS: *Austrochiltonia dalhousiensis* sp. nov., new species, amphipod, artesian springs, Australia, taxonomy.

Introduction

Amphipod species of the genus *Austrochiltonia* are among the most common crustaceans found in the permanent freshwaters of southern Australia ranging from New South Wales to Western Australia and including Tasmania. More recently *Austrochiltonia* has also been found in the inland waters of artesian springs in South Australia (Zeidler 1989) and at "Edgbaston" north-east of Aramac, Queensland (personal collection, May 1988).

When I re-established the genus *Austrochiltonia* (Zeidler 1988) it was my intention to proceed with an Australian revision of the genus beginning with the description of species found in the mound springs near Lake Eyre South and at Dalhousie Springs in northern South Australia. Since then I have examined a large number of specimens from wide-ranging habitats in southern Australia and have found them all to be very similar morphologically and difficult to distinguish from the only previously-described species, *A. australis* (Sayce, 1901) and *A. subtenuis* (Sayce, 1902). Williams (1962) revised the systematics of these two species based on type material and a range of specimens from New South Wales, Victoria, Tasmania and Rottnest Island, Western Australia and likewise found that, morphologically, specific differences are minimal. However, a preliminary analysis of allozymes of specimens from the South Australian mound springs using electrophoresis, indicates that *Austrochiltonia* is most likely a very speciose genus. Given its potential enormity, the project was abandoned due to lack of resources.

The species found at Dalhousie Springs is most similar to *A. australis* Sayce, 1901 in that uropod 3 is two-articulate. It has a very restricted distribution, occurring at only three of about 80 active springs in the region (Zeidler 1989). Two of these springs are quite large, with large outflows of warm water (>40°C) but *Austrochiltonia* is found only in the distant overflow where the water is colder and close to ambient temperature. However, one isolated specimen was collected from the edge of the pool of the main spring, which has a water temperature of about 35°C. The other spring is a small, relatively cold spring on the southern edge of the spring complex. In each case the animals were only found in the shallow edges of swamps or channels amongst the base of the sedge *Cyperus laevigatus* L., 1771 and sometimes also the reed *Phragmites australis* (Cav., 1841).

The restricted and isolated distribution of this species of *Austrochiltonia* makes it vulnerable to habitat disturbance even though Dalhousie Springs is within Witjira National Park. The purpose of this paper is to establish the taxon so that park managers and visitors can appreciate its significance and potential vulnerability.

Materials and Methods

The Dalhousie Springs complex (Fig. 1) consists of about 80 active springs all of which were sampled in 1985 (Zeidler & Ponder 1989) but *Austrochiltonia* was found in only three springs (Fig. 2). The springs are coded following Zeidler & Ponder (1989, Fig. 2).

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Animals were collected from amongst sedges and reeds with a small hand sieve or picked off plant debris with forceps. A total of 424 specimens (230 ♀♀, 174 ♂♂, 20 juveniles) was collected and examined.

Physicochemical data for the sites sampled are limited but some measurements were made near the main source of the spring. These data are given in Table 1 and data on nearby springs are also available (Smith 1989).

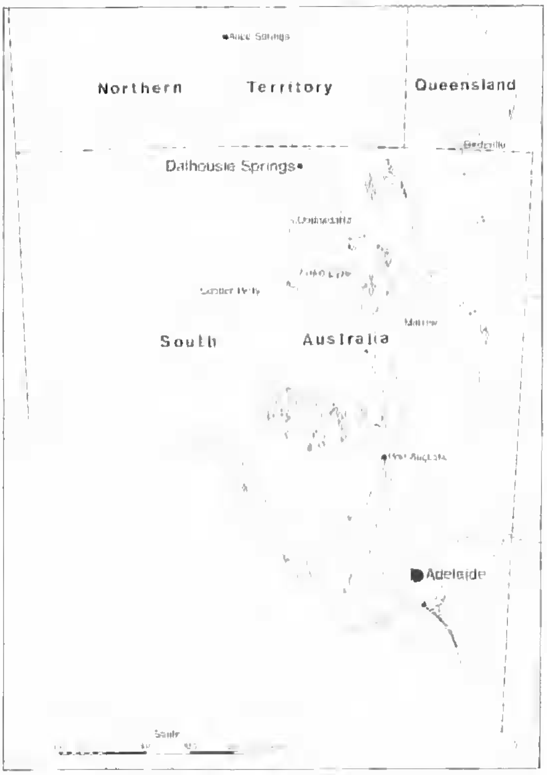

Fig. 1. Location of Dalhousie Springs, South Australia. From Zeidler 1991.

The new species was compared with the descriptions of *Austrochiltonia* given by Williams (1962) and with specimens of *A. australis* from Dandenong Creek, Victoria (SAMA C3872) identified by Williams and used in the study by Smith & Williams (1983).

Material reported here is deposited in the South Australian Museum, Adelaide (SAMA) and the Australian Museum, Sydney (AM). All specimens are preserved in 75% ethanol or 2% formaldehyde/propylene-glycol solution. Of the types, only the holotype and allotype have been dissected (partially), with appendages removed from the left hand side of the animal unless otherwise indicated. Dissected appendages are preserved with the carcass or, in the case of the holotype, the mouthparts, uropods and telson are mounted in polyvinyl lactophenol on a microscope slide.

Specimen length is measured along a lateral parabolic line drawn from the anterior extremity of the head through the mid-line of the body to the posterior limit of the telson using a pair of dividers and scale.

The thoracic limbs are referred to as gnathopod 1 and 2 followed by pereopods 3-7. Size comparisons of gnathopods exclude the coxa and dactylus, and of the pereopods, the coxa, with articles being measured along the mid-line.

The following abbreviations are used in the text and figures. A1, A2 = first & second antenna; G1, G2 = first & second gnathopod; LL = lower lip; Md = mandible; Mx1, Mx2 = first & second maxilla; Mxp = maxilliped; O2-5 = oostegites from pereopods 2-5; P3-7 = pereopods 3-7; Pl1 = first pleopoda; T = telson; U1-3 = uropods 1-3; UL = upper lip; r = used as suffix to indicate that appendage was taken from right hand side of the animal.

TABLE 1 *Temperature measurements and physicochemical data (from Smith 1989) for springs from which amphipods were collected at time of collection (except for Ca1 - data from 1983 expedition)*

Spring	Temp. Air °C	Temp. Water °C	Field Chemistry				
			Temp. °C	Cond. 25°C siemens	TDS mg l^{-1}	pH	DO ppm
Ca1 - channel to main pool	-	-	43	1490	865	7.3	3.8
Ca1 - main pool	20	37	34	1780	1000	7.9	6.7
Ca1 - main discharge channel	25	36	33.5	2050	1150	7.7	4.7
Cd2 - SW edge of pool	15	32	32	1550	850	7.9	11.3
Cd2 - at or near swamp	15	11	18	1650	-	7.8	7.6
Gb1	13	16	20	7610	4850	7.1	4.8

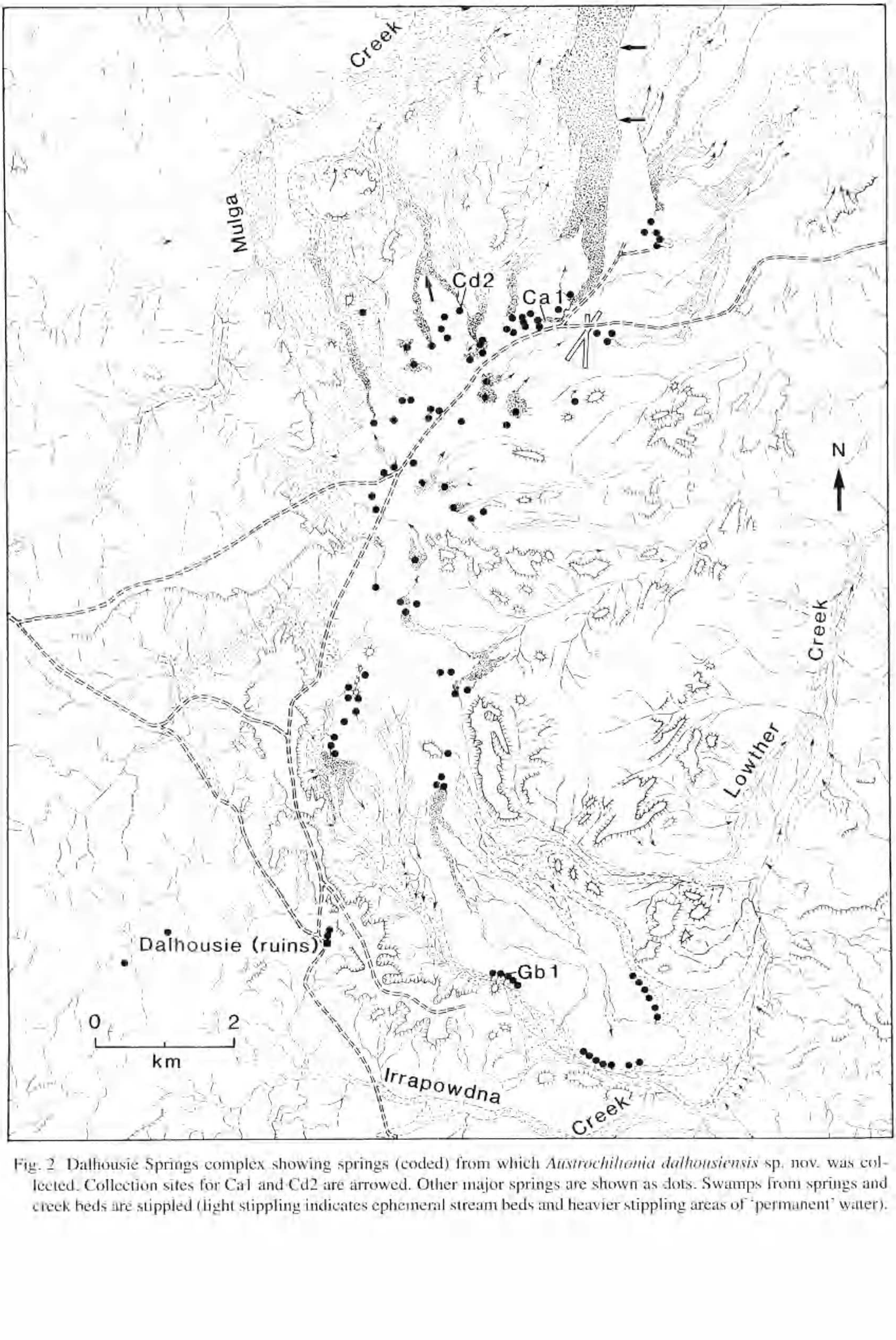

Fig. 2 Dalhousie Springs complex showing springs (coded) from which *Austrochiltonia dalhousiensis* sp. nov. was collected. Collection sites for Ca1 and Cd2 are arrowed. Other major springs are shown as dots. Swamps from springs and creek beds are stippled (light stippling indicates ephemeral stream beds and heavier stippling areas of 'permanent' water).

Systematics

Austrochiltonia dalhousiensis sp. nov.
(FIGS 3-9)

Austrochiltonia sp. Zeidler. 1989: 83-84, fig. 12.1B. 1991: 185

Holotype: ♂, Dalhousie Springs SA, from amongst reeds and sedges along eastern edge of swamp created by outflow from main spring (Ca1), 3.3 km north of edge of old airstrip. 26°23′07″ S 135°30′26″ E. 12.vi.1985. W. Zeidler & K.L. Gowlett-Holmes. SAMA C5651.

Allotype: Ovigerous ♀, SAMA C5652. Collected with holotype.

Paratypes: AM P48840, 10 ♀♀, 10 ♂♂, same data as holotype. SAMA C5653, 24 ♀♀ (one ovigerous), 17 ♂♂, same data as holotype. SAMA C5654, 37 ♀♀ (three ovigerous), 11 ♂♂, same data as holotype except 14.vi.1985. SAMA C5655, 23 ♀♀, 18 ♂♂, same data as holotype but 1.1 km further north, 26°22′26″ S 135°30′26″ E.

Other material examined: All from Dalhousie Springs area (Fig. 2). AM P48841, 1 ♀ (damaged), spring Ca1, 26°25′00″ S 135°29′53″ E, from edge of main pool, W. F. Ponder & D. Winn, 3.vi.1985. SAMA C5656, 21 ♀♀ (three ovigerous), 31 ♂♂, spring Cd2, from edges of swamp formed by outflow, approximately 0.9 km NW of source, 26°24′33″ S 135°28′45″ E, W. Zeidler & K. L. Gowlett-Holmes, 6.vi.1985. SAMA C5657, 14 ♀♀, 21 ♂♂, same data as previous lot except 14.vi.1985. AM P48842, 10 ♀♀ (one ovigerous), 6 ♂♂, spring Gb1, from edges of swamp, 26°31′12″ S 135°29′26″ E, W. F. Ponder & D. Winn, 5.vi.1985. SAMA C5658, 90 ♀♀ (three ovigerous), 61 ♂♂, 20 juveniles, same data as previous lot except collected W. Zeidler & K. L. Gowlett-Holmes.

Description of holotype male (Figs 3-6)

Length 3.8 mm. Head about as long as deep, length almost equivalent to first two pereonites. Antenna 1 about 3x length of head; peduncular article 1 length 1.5x width, articles 2 and 3 subequal in length about 0.75x length of article 1; flagellum slightly longer than 1.5x peduncle, of nine articles with one ventral aesthetasc at base of each of last four articles. Antenna 2 about 0.7x length of A1 with characteristic gland cone at base; peduncular article 1 slightly wider than long, article 2 width about 0.7x length, 2x as long as article 1 and 0.7x length of article 3; flagellum slightly longer than peduncle, of eight articles.

Upper lip slightly wider than long, apically rounded, bearing numerous short setae apically. Lower lip with vestigial inner lobes; outer lobes subovate with setose distal and inner margins.

Mandibles without palp; left with incisor of six teeth, lacina mobilis of five teeth, spine row of three feathered spines and triturative molar; right with incisor of five teeth, lacina mobilis of three teeth, spine row of two feathered spines and triturative molar with one long feathered seta.

Maxilla 1 without palp, notched at palp's normal position; outer plate with nine comb-like spines apically; inner plate very narrow with two feathered spines apically.

Maxilla 2; outer plate about 1.5x length of inner plate, setal row restricted to apex; inner plate with one large seta medially about 0.4 from apex, setal row apically and medially, almost to large seta.

Maxilliped; inner plate large, sub-rectangular, reaching end of merus, maximum width about 3x length of outer margin, with three apical spine teeth, the inner one smaller, four plumose setae on inner margin and several apically; outer plate ovate, reaching midway along inner margin of carpus, about as wide as inner plate, apical margin with three setae, inner margin with several setae for distal half, palp large, 4-articulate; merus proximally narrow, sub-triangular, outer margin about 2x length of inner margin with two setae on inner distal angle; carpus slightly broader than long, slightly expanded distally, distal two-thirds of inner margin with row of setae, two setae on outer distal angle and also near inner distal angle; propodus slightly narrower and shorter than carpus, distal margin with several strong setae; curved dactylus with strong unguis.

Coxal gills sausage shaped, present from G2 to P6.

Gnathopod 1; coxa slightly longer than maximum width, proximal width about 0.7x distal width, anterior margin concave, posterior margin straight, distal margin evenly rounded with several evenly spaced setae; carpus triangular with large posterodistal lobe, with anterior margin almost 2x length of posterior margin, maximum width about 1.5x that of anterior margin, posterior margin with close-set row of nine stout, pectinate spines; propodus sub-rectangular, about 1.4x length of carpus, slightly wider distally, width 0.6x length, posterodistal corner with two stout spines on either side of dactylus, cluster of long setae on anterodistal corner, row of seven long setae medially, mixture of long and short setae near distal margin; dactylus slightly shorter than width of propodus fitting neatly against palm. Gnathopod 2 length 1.6x that of G1; coxal gill length 2x width, little shorter than coxa; coxa rectangular, slightly longer than wide, about 0.8x length of basis, distal margin evenly rounded with several evenly-spaced setae; merus with right-angled bend; carpus similar to G1 but without pectinate spines; propodus slightly shorter than basis, length anterior margin 1.5x maximum width, posteroproximal corner forming rounded lobe, palm oblique with numerous spines of varying lengths on

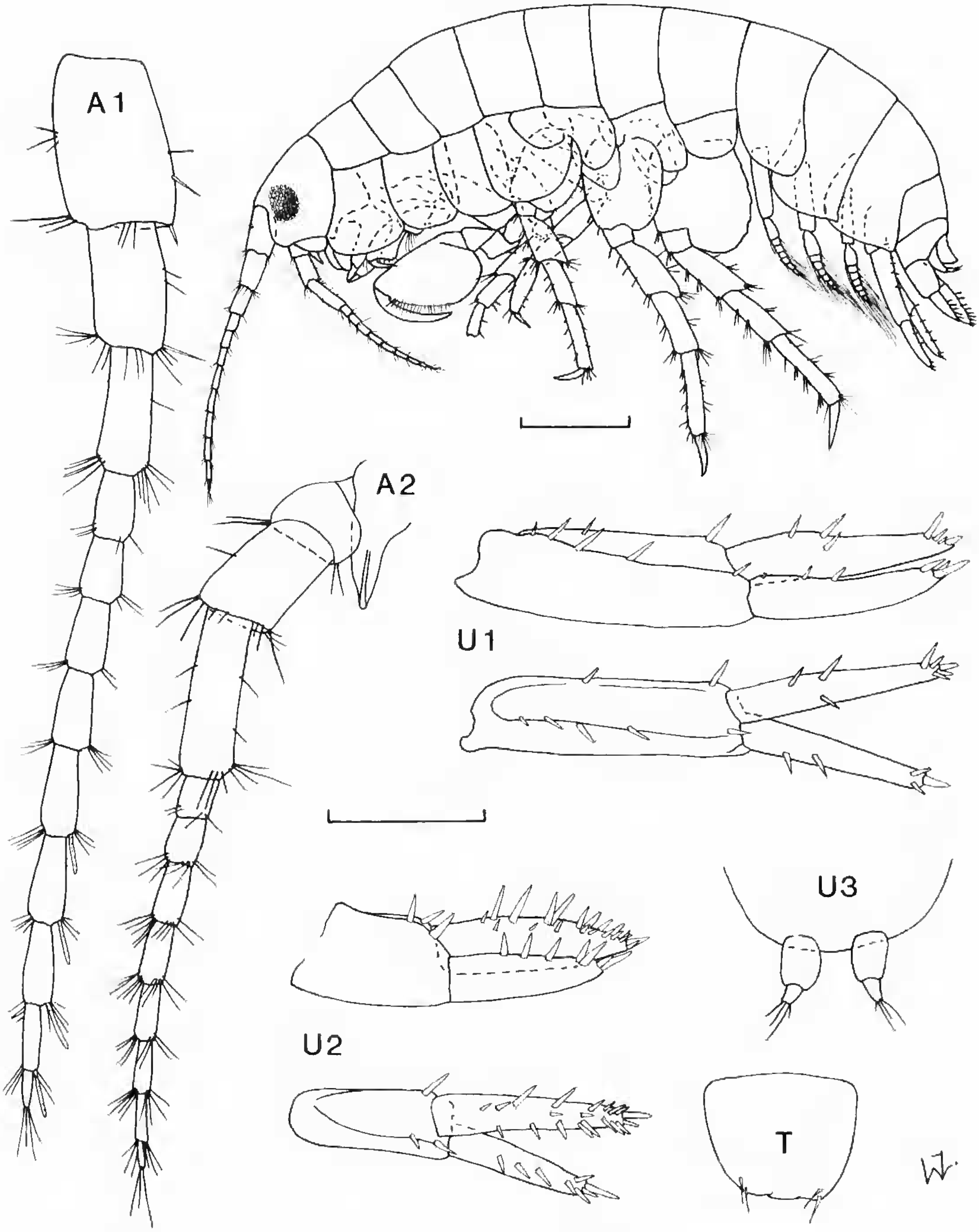

Fig. 3. *Austrochiltonia dalhousiensis* sp. nov., holotype ♂. Scale bars = 1.0mm (whole animal), 0.2 mm (A,U,T).

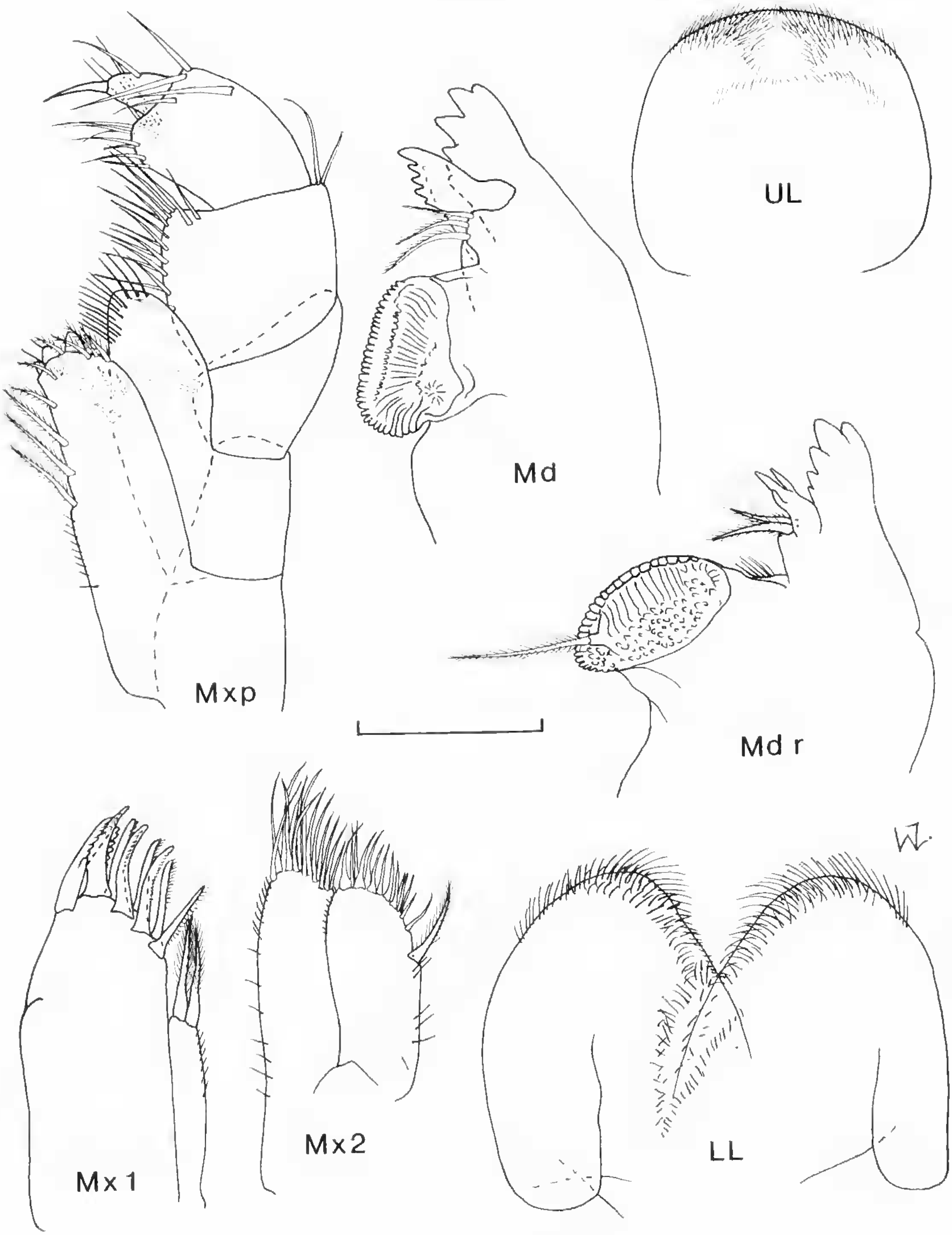

Fig. 4. *Austrochiltonia dalhousiensis* sp. nov., holotype ♂. Scale bar = 0.1 mm.

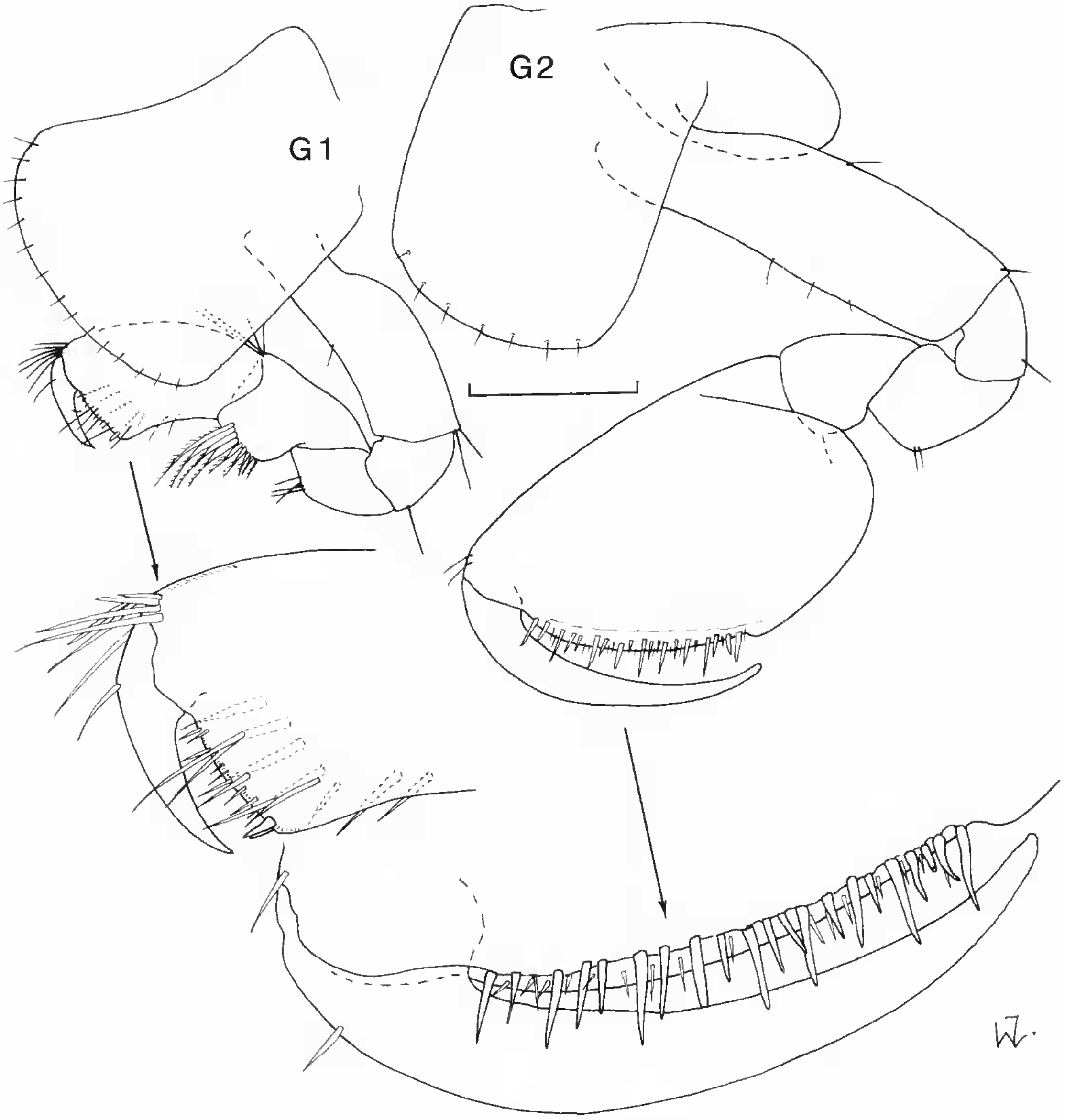

Fig. 5. *Austrochiltonia dalhousiensis* sp. nov., holotype ♂. Scale bar = 0.2 mm.

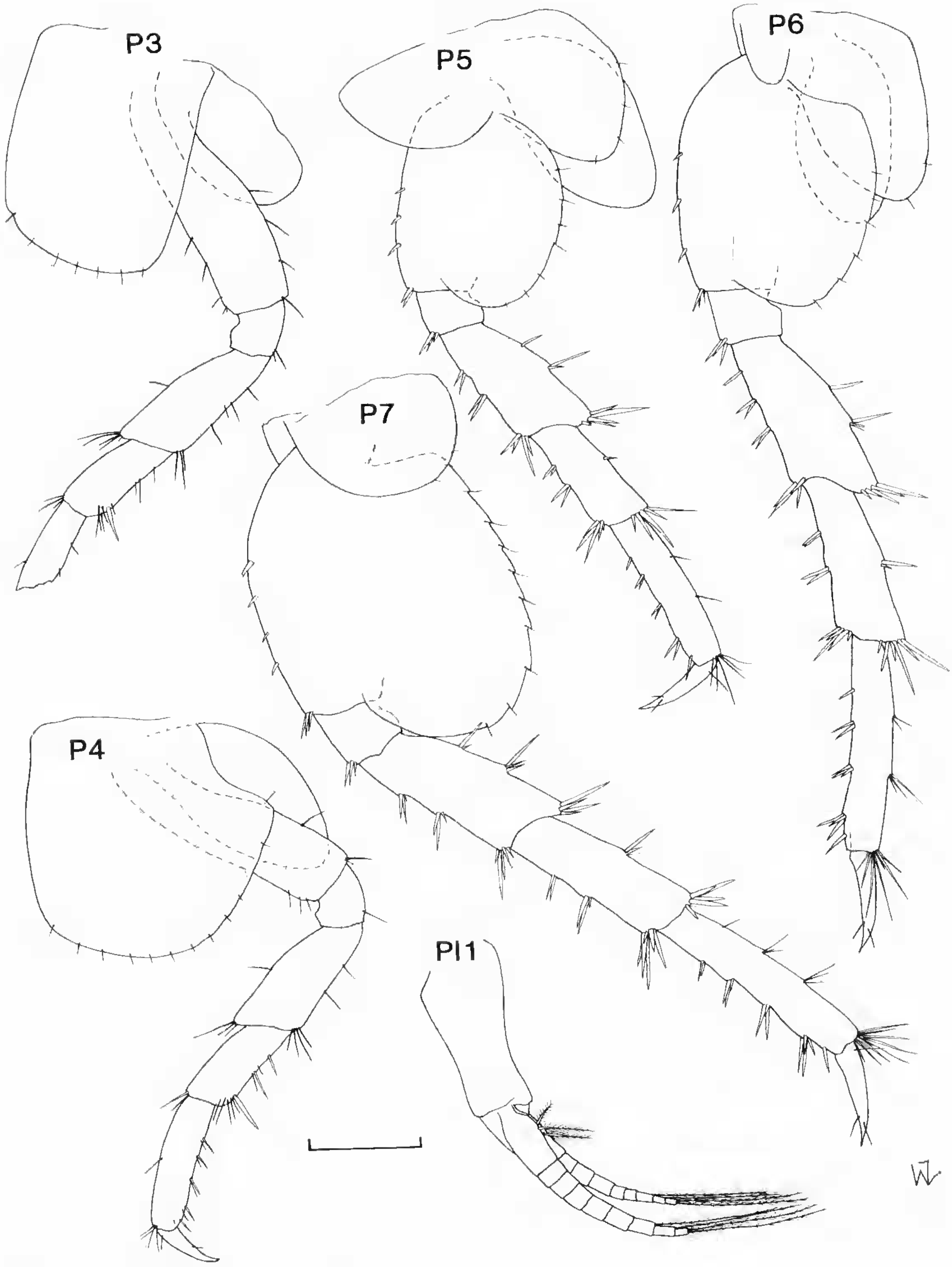

Fig. 6. *Austrochiltonia dalhousiensis* sp. nov., holotype ♂. Scale bar = 0.2 mm.

either side of cutting edge followed by shallow groove for tip of dactylus; dactylus claw-like, as long as anterior margin of propodus.

Pereopod 3 with part of propodus and dactylus missing on right; coxal gill length almost 2x width, about 0.75x length of coxa; coxa like that of G2 but slightly larger, slightly shorter than basis; merus 0.5x as long as basis, anterodistal corner produced, carpus 0.75x length of merus. Pereopod 4 similar to P3; slightly longer than G2; coxa with distinct posteroproximal excavation, maximum width slightly more than length, slightly longer than basis; propodus slightly longer than merus; dactylus stout, length slightly less than 0.5x of propodus. Pereopod 5 slightly longer than P4; coxal gill length about 2x width, slightly longer than basis; coxa width about 1.5x that of basis, anterior lobe slightly more than 0.5x length of basis, posterior lobe about 0.8x length of basis; basis slightly longer than wide with typical expanded posterior margin and posterodistal lobe reaching to about midway of ischium; merus with posterodistal corner produced, length about 0.7x that of basis; carpus slightly shorter than merus; propodus length 1.4x that of carpus; dactylus stout, 0.5x length of propodus. Pereopod 6 length 1.3x that of P5; coxal gill length about 2x width, about 0.75x length of basis; coxa almost as wide as basis, anterior lobe 0.3x length of basis, posterior lobe 0.8x length of basis; remaining articles like those of P5 but basis with straight posteroproximal shoulder and carpus slightly longer than merus. Pereopod 7 longest, slightly exceeding P6, like P6 but coxa semi-circular and lacking coxal gill, width 1.4x length, about 0.4x length of basis; posterodistal lobe of basis more expanded reaching to about midway of merus.

Pleopods all unmodified (not as in *Chiltonia*).

Uropod 1 about 1.5x length of U2; peduncle with spine on inner and outer distal corner, three large and one smaller spine on dorsal outer margin, one small spine on inner margin; outer ramus slightly shorter than inner, length 0.7x that of peduncle, with two median and three terminal spines; inner ramus with two small and three larger terminal spines and three medially. Uropod 2; peduncle with spine on inner and outer distal corner and additional one on dorsal margin; inner ramus 1.2x length of outer ramus and 1.3x that of peduncle, five large spines clustered terminally and three spaced evenly medially; inner ramus with 20 spines of varying sizes gradually closer together towards tip. Uropod 3 two-articulate, marginally more than 0.5x length of telson; ramus 0.5x length of peduncle with three long setae and one short seta terminally.

Telson entire, subrectangular, slightly wider than long, distal margin slightly concave with two small setae at each corner.

Description of allotype female (Figs 7-9)

Length 3.8 mm, ovigerous with 23 eggs in brood-pouch, same as male except for the following.

Antenna 2, flagellum of seven articles.

Gnathopod 1; coxa relatively narrower and longer than for male, width distally 0.8x length; posterior margin of carpus with close-set row of 10 pectinate spines; propodus relatively narrower than for male, slightly longer than carpus. Gnathopod 2 length 1.2x that of G1; coxal gill relatively smaller, less than 0.5x length of coxa; coxa with posterior margin produced to point medially, maximum width 0.8x length, as long as basis; remaining articles like those of G1 only relatively more slender. Pereopod 3 length about 1.3x that of G2; coxa similar in shape to that of G2. Pereopod 4 slightly shorter than P3; coxa without distinct proximal excavation, almost as wide as long. Pereopod 5 only marginally longer than P4; coxa width about 1.7x that of basis; merus, carpus and propodus relatively shorter than for male. Pereopod 6: basis with posterior margin rounded proximally; merus, carpus and propodus relatively shorter than for male. Pereopod 7 slightly shorter than P6; basis relatively narrower, and merus, carpus and propodus successively slightly shorter than for male.

Oostegites on coxae 2-5, all with curled margins and numerous small hooks, together forming tight marsupium. First heart-shaped, length 1.6x maximum width, about 0.7x length of G2; second trapezoid, length almost 0.5x that of P3, maximum width almost 0.5x length; third oval-shaped of similar size to second; fourth sub-rectangular with oblique distal margin, length anteriorly almost 0.5x that of P5, maximum width almost equal to length of posterior margin.

Uropod 1 length 1.6x that of U2; peduncle with five large and one small spine on outer margin, inner margin with two small spines proximally in addition to large spine on distal corner; outer ramus as long as inner, length 0.8x that of peduncle, with two large and two smaller spines terminally and two medially; inner ramus with three large and two smaller spines terminally and two medially. Uropod 2 peduncle with two large spines on outer margin; outer ramus slightly shorter than inner, length 1.3x that of peduncle, one large and two smaller spines terminally, three large spines medially; inner ramus with two terminal spines, cluster of four near tip and another two medially.

Telson with group of three small setae at each corner.

Etymology

Taken from the type locality in recognition of the restricted distribution of the species.

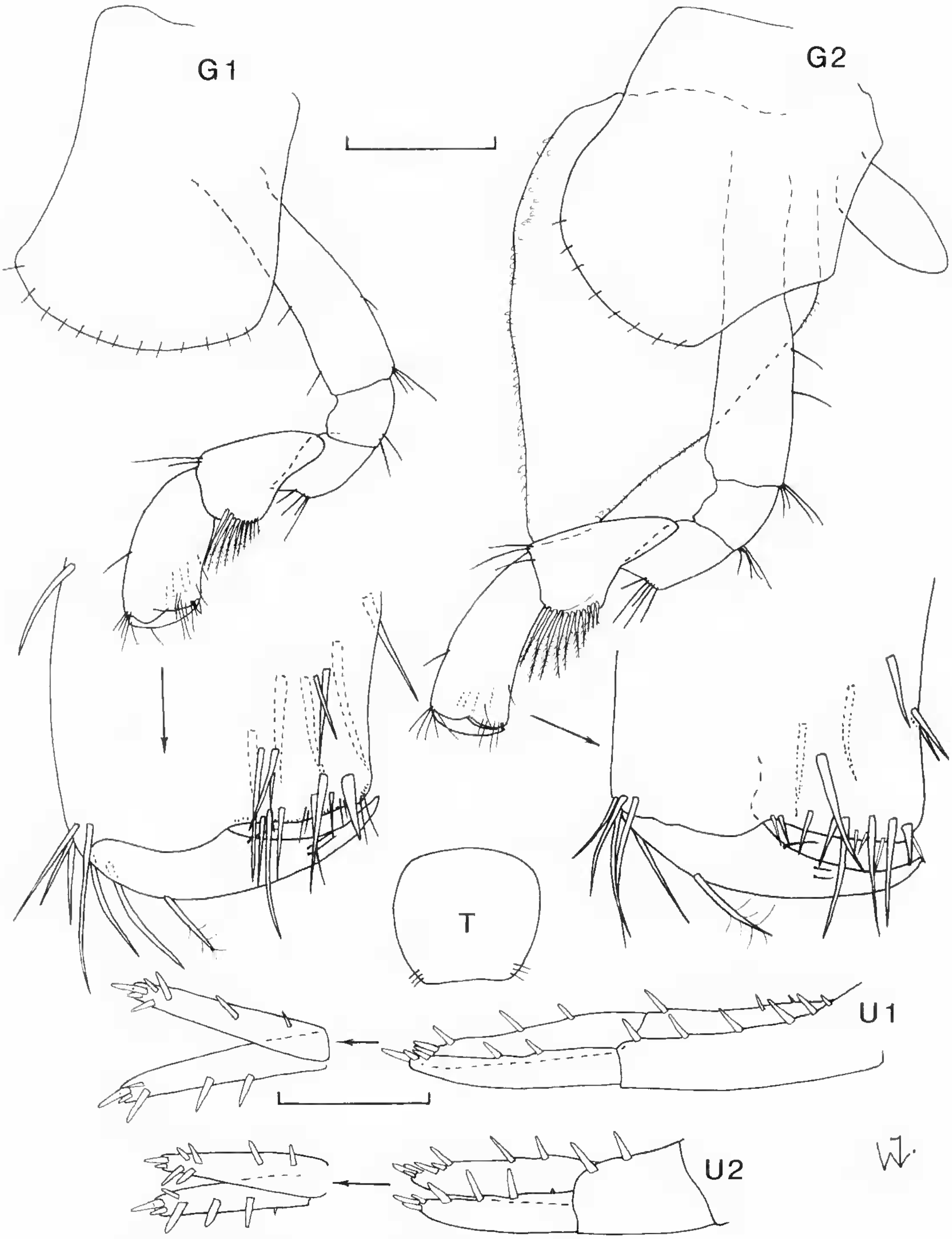

Fig. 7. *Austrochiltonia dalhousiensis* sp. nov., allotype ♀. Scale bars = 0.2 mm.

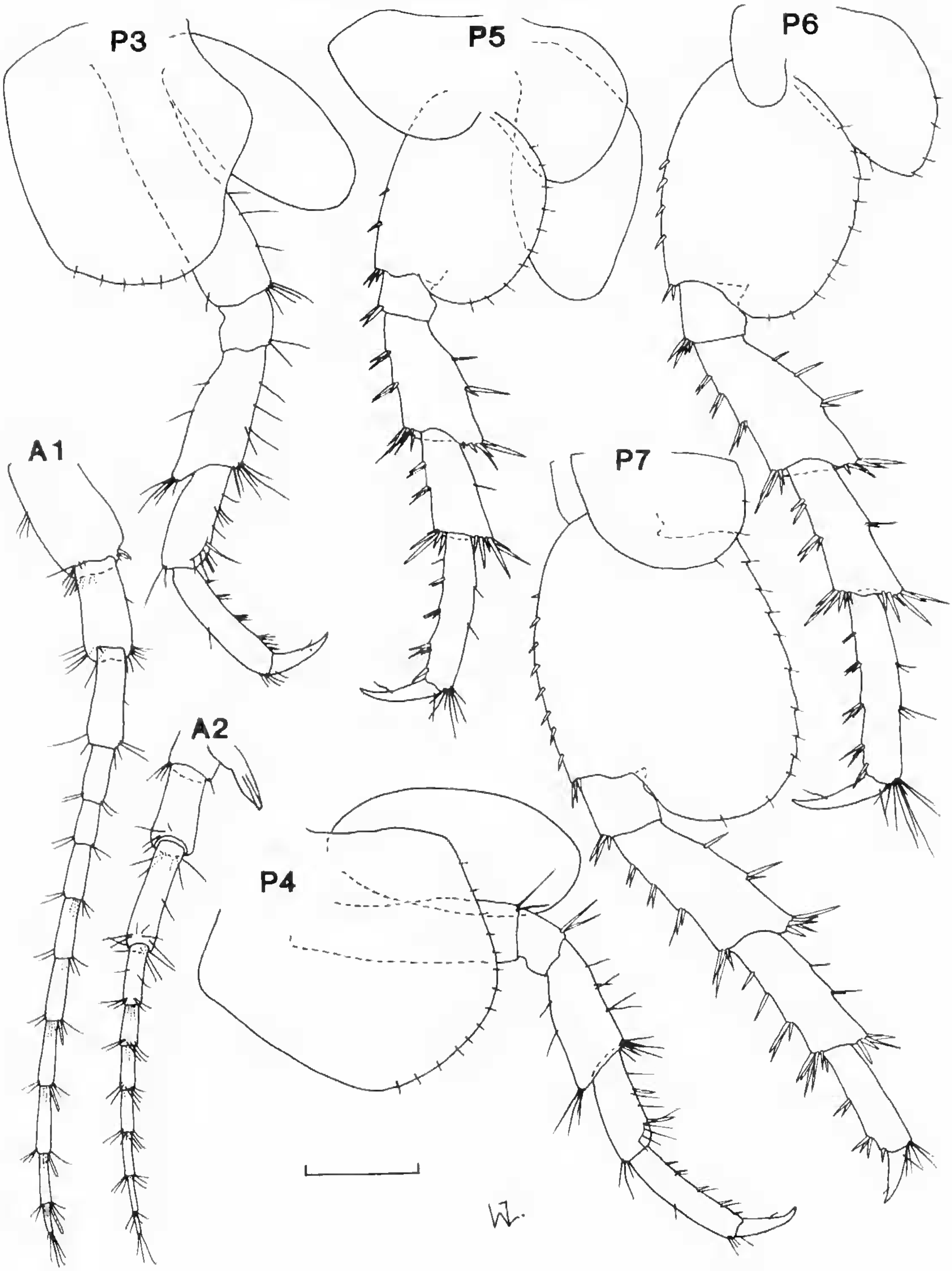

Fig. 8. *Austrochiltonia dalhousiensis* sp. nov., allotype ♀. Oostegites on P3-5 not illustrated. Scale bar = 0.2 mm.

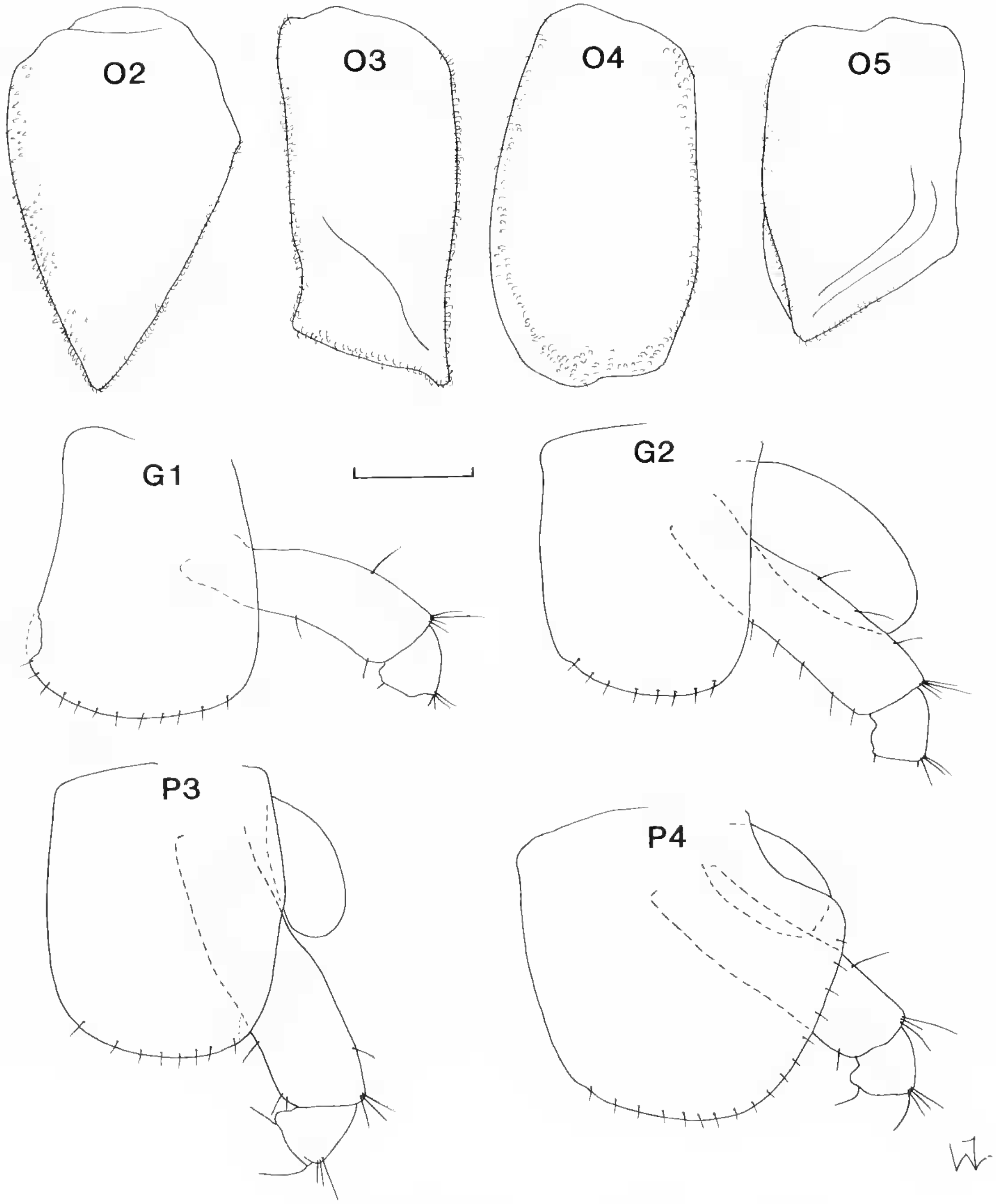

Fig. 9. *Austrochiltonia dalhousiensis* sp. nov. Oostegites from allotype ♀. G1-P4 from paratype ♀, 4.8 mm, from SAMA C5653. Scale bar = 0.2 mm.

Variation

Apart from minor variations due to size, paratype and other material examined is very similar to either the holotype or allotype. The maximum recorded size of males is 5.2 mm and that of females 6.5 mm but most specimens examined are around 4.0 mm long. Minor differences between specimens generally were noted as follows. The number of flagellar articles of A1 varies from eight to ten with one small specimen having seven; A2 has from six to nine flagellar articles but most specimens have only seven or eight. The number of aesthetases on A1 is remarkably constant with only some larger specimens having an extra one (five). The number of pectinate setae on the carpus of G1 varies from seven to nine in males and eight to ten in females (similarly for G2 of females). In the allotype the coxae of G2-P4 are of an unusual shape, differing from males and non-ovigerous females (Fig. 9) in that the posterior margin is produced to a point medially and P4 is without a proximal excavation. In the holotype the basis of P6 has a relatively straight posteroproximal shoulder but in nearly all other specimens examined the posterior margin is evenly rounded. Pereopod 7 is usually longer than P6 but in the allotype it is slightly shorter, probably because of the relatively shorter propodus which is normally longer than the carpus. The spination of U1 & 2 varies slightly with larger specimens having one or two extra spines on the peduncle and rami. Uropod 3 is usually two-articulate and only one specimen (a female from C5653) had U3 with one article and then only on the right-hand side. Oostegites of females vary considerably in size but are expanded, as illustrated for the allotype, in ovigerous specimens.

The possibility that speciation may have occurred between springs without any obvious morphological changes was considered and specimens for allozyme electrophoretic analysis were collected from all three localities. A preliminary analysis of this material using methods outlined by Richardson *et al.* (1986) indicated fixed genetic differences of 10% or less (for 21 loci), thus supporting the morphological evidence of one species with little variation. Given these results, a more detailed analysis was considered unnecessary.

Discussion

The new species described here closely resembles *A. australis* in that U3 is two-articulate. However, a number of minor features collectively readily distinguish it from this species and its only other congener, *A. subtenuis*. The main distinguishing features are as follow. Females reach a larger size than males and the species is generally not as large as *A. australis* (males up to 10.0 mm, females up to 8.3 mm) or *A. subtenuis* (males up to 10.0 mm, females up to 6.4 mm). Antenna 1 has fewer aesthetases (5-7 in *A. australis*). Both antennae have fewer flagellar articles (A1 up to 17, A2 up to 11 in *A. australis*). The coxae of *A. dalhousiensis* sp. nov. are relatively wider and the excavation on coxa 4 is not as deep as in *A. australis* or *A. subtenuis*. In both *A. australis* and *A. subtenuis*, the lateral margin of the excavation of coxa 4 is at right-angles to the posterior margin whereas in *A. dalhousiensis* the angle of the coxal excavation is much greater than 90°. In ovigerous females of *A. dalhousiensis* the coxae of G2-P4 have the posterior margin produced to a point medially and coxa 4 is without a characteristic excavation. There are fewer pectinate spines on the carpus of G1 (males) and G1 & 2 (females) than in *A. australis* (usually >>10). For G1 (males) and G1 & 2 (females) the carpus is slightly shorter than the propodus whereas the reverse is true for *A. australis*. Other minor differences between the new and other species no doubt exist but were not evident in the present study.

Austrochiltonia dalhousiensis is also similar to *Phreatochiltonia anophthalma* Zeidler, 1991, a phreatic species which also has a limited distribution at Dalhousie Springs (Zeidler 1991), especially in that ovigerous females of *A. dalhousiensis* have coxa 4 without an excavation, a feature characteristic of *P. anophthalma*. Given the isolated habitat of Dalhousie Springs, one would suspect that these two species would have common ancestry. However, since electrophoretic analysis has shown that they differ at about 80% of the 21 loci examined, this does not appear to be the case.

The closest relatives geographically, apart from *P. anophthalma*, are species of *Austrochiltonia* found in the mound springs near Lake Eyre South. Although *A. dalhousiensis* is morphologically very similar to these species, electrophoretic analysis has shown that it differs from them at 73-80% of the 21 loci examined. Clearly a more detailed morphological and genetic study of the genus is required to determine relationships.

A single, damaged female of *A. dalhousiensis* was found in the pool of spring Ca1 (AM P48841). This record may be due to contaminated collecting equipment as the water temperature at that locality is 37°C and freshwater amphipods prefer cooler waters (Barnard & Barnard 1983). It therefore seems unlikely that *A. dalhousiensis* occurs naturally in the pool of Ca1 but its possible occurrence at this locality warrants further investigation.

The factors determining the distribution of this species are unknown. Its restricted distribution at Dalhousie Springs is puzzling as many apparently suitable habitats exist in which this species was not found. Although restricted in its distribution, the species is relatively abundant at all of the collection sites.

Like *P. anophthalma*, the presence of this species at Dalhousie Springs on the edge of the Simpson Desert suggests that it is a remnant of a once more widespread fauna during a time when central Australia was much wetter than it is today (Krieg 1989).

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